

PATENT CLAIMS

1. A semiconductor laser device comprising
an optically pumped surface-emitting vertical emitter
5 region (2) which has an active radiation-emitting
vertical emitter layer (3) and
at least one monolithically integrated pump
radiation source (5) for optically pumping the vertical
emitter (2), which has an active radiation-emitting
10 pump layer (6),
characterized in that
the pump layer (6) follows the vertical emitter
layer (3) in the vertical direction,
a conductive layer (13) is provided between the
15 vertical emitter layer (3) and the pump layer
(6),
a contact (9) is applied on the side of the
semiconductor layer device which is closer to
the pump layer (6) than to the conductive layer
20 (13), and
an electrical field can be applied between the
conductive layer (13) and the contact (9) for
generating pump radiation (7) by charge carrier
injection.
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2. The semiconductor laser device as claimed in claim
1, characterized in that the semiconductor laser device
is partially ablated so that the conductive layer (13)
is partially exposed.
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3. The semiconductor laser device as claimed in claim
2, characterized in that the semiconductor laser device
is ablated in the form of parallel trenches (22).
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4. The semiconductor laser device as claimed in claim
2 or 3, characterized in that a further contact (15) is
applied to the exposed areas of the conductive layer
(13).

5. The semiconductor laser device as claimed in claim 4, characterized in that a layer (14) which is conductive and which is transparent for radiation of a wavelength as generated by the vertical emitter region (2) is provided between a conductive layer (13) and the further contact (15).

6. The semiconductor laser device as claimed in one of claims 2 to 5, characterized in that, an etch stop layer (17) which is resistant to an etching process which is suitable for exposing the conductive layer (13) is provided adjacently to the conductive layer (13).

7. The semiconductor laser device as claimed in one of claims 1 to 6, characterized in that the conductive layer (13) is arranged vertically in such a manner that it is located in a node of the radiation field in the resonator of the vertical emitter region (2).

8. The semiconductor laser device as claimed in one of claims 1 to 7, characterized in that a vertical waveguide structure (16) is provided between the vertical emitter layer (3) and the conductive layer (13).

9. The semiconductor laser device as claimed in claim 8, characterized in that the vertical waveguide structure (16) has other optical characteristics in the region in which it is located between the contact (9) and the further contact (15), seen laterally, than in the region in which it is not located between the contact (9) and the further contact (15).

10. The semiconductor laser device as claimed in claim 9, characterized in that, the vertical waveguide structure (16) is oxidized in the region in which it is located between the contact (9) and the further contact (15), seen laterally.

11. The semiconductor laser device as claimed in one of claims 1 to 10, characterized in that the pump layer (6) and the vertical emitter layer (3) are followed in
5 the vertical direction by an internal cavity reflective structure.

12. The semiconductor laser device as claimed in claim 11, characterized in that the internal cavity
10 reflective structure is a Bragg reflector structure (10)

13. The semiconductor laser device as claimed in one of claims 11 or 12, characterized in that the internal
15 cavity reflective structure is arranged between the vertical emitter layer (3) and a substrate (8) and the radiation generated by the vertical emitter layer (3) is launched on the side opposite the substrate.

20 14. The semiconductor laser device as claimed in one of claims 1 to 13, characterized in that the vertical emitter layer (3) is associated with an external resonator reflector (19) which, together with the internal cavity reflective structure, forms the
25 resonator for the vertical emitter region (2).

15. The semiconductor laser device as claimed in claim 14, characterized in that beam-shaping elements are arranged in the resonator.

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16. The semiconductor laser device as claimed in one of claims 14 or 15, characterized in that frequency-selective elements are arranged in the resonator.

35 17. The semiconductor laser device as claimed in one of claims 14 to 16, characterized in that frequency-converting elements are arranged in the resonator.

18. The semiconductor laser device as claimed in one of claims 1 to 17, characterized in that the vertical emitter layer (3) and/or the pump layer (6) in each case have one or more quantum well structures.

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19. The semiconductor laser device as claimed in claim 14, characterized in that the quantum well structures can contain quantum troughs, quantum wires, quantum dots and any combination of these structures.

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